



HAWAII STATE  
DEPARTMENT  
OF HEALTH

## **FREQUENTLY ASKED QUESTIONS:**

### ***WATER WARNINGS AND ADVISORIES***

***Q: When are warning signs posted?***

A: The owner or operator of a facility causing a sewage spill or discharge to state waters is required to post warning signs immediately in the areas likely to be affected by the spill and where public access is possible. The owner or operator must then start taking samples of the waters for testing, notify the DOH, and for spills/discharges of 1000 gallons or more, notify the media.

The owner/operator must get DOH permission to take signs down, and the DOH analyzes testing results before permitting signs to be removed.

For other types of spills, discharges, or conditions, the DOH uses its judgment on posting warnings. For reasons explained below, high indicator bacteria test results by themselves do not necessarily mean that human sewage is present. Bacteria test results do not by themselves lead to posting warning signs, though advisories are/will be provided.

***Q: What does the DOH or others test the water for?***

A: DOH tests ocean and stream water for the indicator bacteria *Enterococcus* and *Clostridium perfringens*. Levels of these bacteria are used to detect the presence of human sewage in water.

### ***BACTERIA***

***Q: What is Enterococcus?***

A: Enterococci is an aerobic bacteria found in the feces of warm blooded birds and mammals including man. It is also found in the feces of rats, chicken, cats, rabbits, mice, pigs, sheep, cows, dogs, pigeons, ducks, and geese. In tropical areas, Enterococcus has been shown to reproduce in the soil given a nutrient source.

***Q: Why do you sample for Enterococcus?***

A: The DOH follows federal requirements. In 1972, EPA conducted a series of tests at beaches that were affected by discharges from Sewage Treatment Plants. They were looking for ways to predict health risks. Several different bacteria levels were measured

while at the same time, swimmers were interviewed to determine if they became sick after swimming at these beaches. The studies showed a fairly strong correlation between *Enterococcus* and gastro-intestinal illnesses from contact with sewage contaminated water. *Enterococcus* is also thought to die off in the water about as fast as many other harmful bacteria and viruses (pathogens) in human sewage. Based on these results, EPA has recommended the use of *Enterococcus* as the indicator organism for human fecal contamination.

***Q: What is meant by indicator organism?***

A: Because it is not practical to sample for every virus and bacteria (pathogens) in human fecal matter, we look for an indicator organism that is representative of them.

***Q: What is a pathogen?***

A: A pathogen is a bacteria or virus harmful to people.

***Q: What is *Clostridium perfringens*?***

A: *Clostridium perfringens* is an anaerobic bacteria. *Clostridium* is found in the feces of humans, cats, pigs, sheep, dogs, ducks, and geese in large numbers. *Clostridium* cannot reproduce in the soil but can survive for a long time in a spore stage.

***Q: Why do you sample for *Clostridium perfringens*?***

A: Studies have shown that *Enterococcus* can be present and grown in tropical soils even in the absence of human sewage. The DOH wants a more specific indicator for human sewage and *Clostridium* is one. Although it is not officially recognized by EPA, the Clean Water Branch is allowed to use it as a secondary indicator or tracer for human fecal contamination.

***Q: Why do you use both *Enterococcus* and *Clostridium perfringens*?***

A: *Enterococcus* is one of only two indicators allowed by EPA, and is the one chosen by DOH. The DOH also views it as better reflecting the survival times for most sewage pathogens. *Clostridium* is more specific for human sewage but can survive for a long time in the water.

***Q: How accurate are the *Enterococcus* and *Clostridium* indicators?***

A: They have value when human sewage is present, but they must be used cautiously because their tests also detect animal and bird waste and the *Enterococcus* test detects bacteria from soil.

## *TESTING*

***Q: Where does the DOH test?***

A: The DOH tests the waters at sandy beaches and in other coastal areas throughout the state, and the DOH tests freshwaters. Testing is focused on recreational waters where people swim and play. Although we sometimes use the term beach monitoring, we actually mean coastal recreational water monitoring. The federal Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 defines beaches as coastal recreational waters. Monitoring includes both taking water samples and observing conditions. For purposes of discussions, we use the term beach area, beaches, coastal recreational waters to mean the same thing.

***Q: Do you sample every beach in the State?***

A: No, there are over 400 beach areas in the State of Hawaii and logistically it is not possible to sample all 400 beach areas in a year and in a responsible manner. So we divided up the beach areas into 2 tiers. Tier 1 beaches are our most used, popular, and at risk beaches. Tier 2 beaches are the remainder of the beaches.

***Q: How often does DOH sample?***

A: Our Tier 1 beaches are monitored twice a week year round, while Tier 2 beaches are monitored once a week. Every six months a new set of Tier 2 beaches are monitored. This way, we will eventually sample every beach in the State.

***Q: How quickly do you get the results of the sampling?***

A: At least 24 hours after sample collection. After collection, the water sample must be processed, and a culture must be incubated for at least 24 hours, then read by the laboratory. So the earliest we can get results is the next day.

## *STANDARDS*

***Q: What are the standards for Enterococcus?***

A: In part, the State of Hawaii, marine water standard for coastal recreational waters up to 300 meters from shore is a steady state or geometric mean indicator density of 7 CFU/100mL. For Marine Waters beyond 300 meters, it is a steady state or geometric mean indicator density of 35 CFU/100mL. The Federal standard for Marine coastal recreational waters is a geometric mean of 35 CFU/100mL. Hawaii also has a single sample maximum standard of 100 CFU/100mL for coastal recreational waters (up to 300 meters or 1000 feet from shore). This is discussed more below. The DOH rule for

recreational water is in Hawaii Administrative Rules section 11-54-8 and can be found at <http://www.hawaii.gov/health/about/rules/admrules.html>.

***Q: What is CFU?***

A: CFU means Colony Forming Units, a measure of bacteria.

***Q: What is mL?***

A: ML is milliliters, a metric measure of water volume.

***Q: What is a geometric mean?***

A: A geometric mean is a measure of central tendency, similar to an arithmetic mean (“average”), or median. It is a useful summary when we expect that changes in the data occur in a relative fashion and when the data may vary greatly. It is the Nth root of the product of N values, where N is the number of samples.

***Q: How does the DOH determine compliance with the geometric mean standard?***

A: Our rules require that the geometric mean cover a 30-day period, or if 5 or more samples are taken, the mean applies to a 25-day period. If the geometric mean exceeds 7 CFU/100mL, then the water body is not in compliance with the standard.

***Q: Why is there a difference between the Federal guideline and the State standard for the Enterococcus geometric mean?***

A: *Enterococcus* levels were correlated to the risk of swimmers contracting gastro-intestinal illnesses from exposure to sewage contamination. The higher the concentration of *Enterococcus*, the more swimmers are expected to become ill. At 35 CFU/100 ml, EPA predicted that 19 swimmers per 1000 would become ill. A past DOH Deputy Director thought that 19 illnesses per 1000 swimmers was too high and wanted a standard for 10 illnesses per 1000 swimmers. The corresponding standard was calculated to be 7 CFU/100ml, though there are no studies specifically establishing that number. Thus, our standard was lowered from 35 to 7 CFU/100mL and is the most stringent standard in the United States.

***Q: What is a single sample maximum?***

A: It is a maximum allowed value for a single sample. Under EPA’s guidance document, it actually represents a value from which one may conclude with a given level of confidence that the geometric mean standard would be violated if more samples were taken.

***Q: Why have a Single Sample Maximum (SSM)?***

A: First, for beach monitoring and beach notification and closure decisions, beach managers frequently need to make decisions based on one or very few days of sampling. Thus, having a trigger level for a single sample value enables beach managers to make a decision much sooner for the protection of public health at beaches. Second, under the BEACH Act of 2000, Hawaii in September 2004, was required to adopt a secondary standard for *Enterococcus* called a Single Sample Maximum (SSM). The DOH rules use the 100 CFU/100mL SSM for coastal recreational waters, which extend 300 meters (1000 feet) from shore.

***Q: Why are the single sample maximum and geometric mean for Enterococcus different?***

A: Statistically, SSM is supposed to be merely a different expression of the geometric mean, at a given level of confidence in the expression. Under the BEACH Act, there are four different SSM, which vary for marine coastal recreation waters based on intensity of use. The four different SSM are: 100 CFU/100mL for Designated bathing beach (75% confidence level), 158 CFU/100mL for Moderate use coastal recreational waters (82% confidence level), 276 CFU/100mL for Light use coastal recreation waters (90% confidence level), and 501 CFU/100mL for Infrequent use coastal waters (95% confidence level).

***Q: What is meant by 100cfu/100mL for Designated Bathing Beach (75% confidence level)?***

A: If the geometric mean at a marine Designated Bathing Beach is 35 cfu/100mL(national standard), then there is only a 25% probability that the concentration of *Enterococci* in a single sample from that beach would be over 100 cfu/100mL. In other words, if a sample taken at a beach is 101cfu/100mL, then we know with a 75% confidence level that the geometric mean of 35 cfu/100mL has been would be? exceeded, but we can be wrong 25% of the time. For the other extreme, a SSM of 501cfu/100mL tells us that we can be 95% sure that the geometric mean of 35 cfu/100mL has been exceeded and we could be wrong 5% of the time.

***WHEN STANDARDS ARE EXCEEDED***

***Q: What does the State do when the SSM is exceeded?***

A: As stated in the EPA Final Rule, “States and Territories will use a single sample maximum to trigger a notification or closure action at beaches; whether the action taken is an advisory or a closure depends on the decision rules established by the State, Territory or local beach management authority, although the National Beach Guidance and required Performance Criteria for Grants requires the State or Territory to provide a notification of the exceedance.” Because of the high background numbers for *Enterococcus*, especially during high rainfall/ storm water events, and because soil

conditions can cause high numbers of *Enterococcus* without any human sewage present, exceedance of SSM triggers the DOH to issue an advisory. A 2005 California epidemiological study found no correlation between indicator bacteria levels and swimmers' illness and infection rates in waters where there was no human sewage. Weeks after the March 2006 Ala Wai Canal sewage spill/discharge, enterococcus numbers were much higher in Manoa Stream upstream from the canal, even though there were no known sewage discharge upstream.

***Q: What if the result is above either the geometric mean or SSM standard?***

A: The DOH looks closely at any test results above either standards. (DOH requires that warning signs should be posted immediately for waters affected by sewage spills or discharges, and sampling started afterwards.) The DOH investigates unusual test results. When the DOH takes *Enterococcus* samples, we simultaneously monitor other parameters. In particular, we look at *Clostridium perfringens*, salinity and turbidity. The DOH also keeps an eye out for unusual conditions (e.g. rain, high waves, stream discharges, animals, etc.). Experience and years of testing has taught us that there are other sources of *Enterococcus* in the environment. These additional parameters help us to determine if the source of the high *Enterococcus* levels are a result of a sewage discharge or some other source.

If the cause is likely from sewage, the area would be posted with warning signs, public notifications issued, and surveys conducted to identify the source of the *Enterococcus*. Once the source is identified, corrective actions would be taken to prevent further discharge of the sewage. Legal actions may be taken against the responsible party.

If the *Enterococcus* originates from natural sources (e.g. stream, storm drain runoff, or animals), additional samples would be taken to ensure that the counts return back below the standard.

***Q: What is the difference between *Enterococcus* from sewage and *Enterococcus* from other sources?***

A: Current tests used to determine whether standards are met cannot distinguish between the different sources.

## ***FUTURE ACTIONS***

***Q: Is the DOH considering changing its standards?***

A: Yes, for discussion the DOH has drafted proposed revisions to change the 7 CFU/100ml geometric mean standard to 35 CFU/100mL and to extend the SSM of 100 CFU/100mL from 300 out to 500 meters from shore. These are informal department proposals that are not an official departmental or state proposal now.

***Q: Why is the DOH considering revising the standards?***

A: 7 CFU/100mL may have been appropriate back when established, but the DOH now thinks that additional and newer factors justify the change. The DOH will likely be able to use more rapid testing if it changes. All research and development for rapid detection of indicator bacteria is focused on the 35 level. No other state or territory is interested in developing rapid tests for the 7 CFU/100mL level. The DOH wants a better way to distinguish natural conditions from sewage contamination. In many Hawaii coastal areas, ambient levels representing natural conditions exceed the 7 CFU/100mL.

The DOH wants more consistent state standards and to reduce potential confusion over what protects health. Our present geometric mean standards are 33 CFU/100mL for streams, 7 CFU/100mL for coastal waters out to 300 meters, and 35 CFU/100mL beyond 300 meters. A 25 CFU/100mL level supposedly protects health in streams and deep ocean water, but not near shore. No other state has lowered their standard below 35 CFU/100mL.

***Q: Will raising the level to 35 endanger the people of Hawaii?***

A: No, it will not. Data from the other 35 coastal, Great Lakes states and Territories do not show any endangerment at the 35 CFU/100mL level.